CLAIMS

1. An image system comprising:

an optical system for receiving an optical image from an object and guiding the optical image to a predetermined position;

image processing means including a sensor for photoelectrically converting the optical image guided to the predetermined position into an electrical signal corresponding to a light amount of the optical image in units of pixels; and

a signal processing device for processing an output from said image processing means in a predetermined form, and outputting the output,

said sensor comprising:

a photoelectric conversion element placed at the predetermined position,

an output circuit including an amplification MOS transistor connected to said photoelectric conversion element serving to amplify and output an output from said photoelectric conversion element at a first timing and output noise irrelevant to the output from said photoelectric conversion element at a second timing, and

a noise reduction circuit connected to an output of said output circuit, having the same impedance at the first and second timings when viewed from said output circuit, and serving to obtain a

difference between outputs from said output circuit at the first and second timings.

2. An image system comprising:

an optical system for receiving an optical image from an object and guiding the optical image to a predetermined position;

image processing means including a sensor for photoelectrically converting the optical image guided to the predetermined position into an electrical signal corresponding to a light amount of the optical image in units of pixels; and

a signal processing device for processing an output from said image processing means in a predetermined form, and outputting the output,

said sensor comprising:

a photoelectric conversion element placed at the predetermined position,

an output circuit including an amplification MOS transistor connected to said photoelectric conversion element and serving to amplify and output an output from said photoelectric conversion element at a first timing and output noise irrelevant to the output from said photoelectric conversion element at a second timing,

a signal line connected to an output of said output circuit,

a source follower circuit having an input

connected to said signal line,

a clamp capacitor having one end connected to an output of said source follower circuit,

a sample/hold capacitor connected between the other end of said clamp capacitor and a first predetermined potential, and

a clamp transistor connected between the other end of said clamp capacitor and a second predetermined potential and serving to selectively clamp said sample/hold capacitor.

3. An image system comprising:

an optical system for receiving an optical image from an object and guiding the optical image to a predetermined position;

image processing means including a sensor for photoelectrically converting the optical image guided to the predetermined position into an electrical signal corresponding to a light amount of the optical image in units of pixels; and

a signal processing device for processing an output from said image processing means in a predetermined form, and outputting the output,

said sensor comprising:

a photoelectric conversion element placed at the predetermined position,

an output circuit including an amplification MOS transistor connected to said photoelectric

conversion element and serving to amplify and output an output from said photoelectric conversion element at a first timing and output noise irrelevant to the output from said photoelectric conversion element at a second timing,

a signal line connected to an output of said output circuit,

a clamp capacitor having one end connected to said signal line,

a sample/hold capacitor connected between the other end of said clamp capacitor and a first predetermined potential, and

a clamp transistor connected between the other end of said clamp capacitor and a second predetermined potential and serving to clamp said sample/hold capacitor at a predetermined timing.

4. An image system comprising:

an optical system for receiving an optical image from an object and guiding the optical image to a predetermined position;

image processing means including a sensor for photoelectrically converting the optical image guided to the predetermined position into an electrical signal corresponding to a light amount of the optical image in units of pixels; and

a signal processing device for processing an output from said image processing means in a

predetermined form, and outputting the output,

said sensor comprising:

a pixel for outputting a voltage corresponding to noise and the light amount at a first timing, and outputting a voltage corresponding to the noise at a second timing, and

a noise reduction circuit including a three-terminal element having a first node to which an output from said pixel is supplied, and a second node for storing a charge, and a third node to which a predetermined amount of charge controlled in accordance with a potential of said first node is transferred from said second node, and serving to obtain a difference between outputs from said pixel at the first and second timings.

5. An image system comprising:

an optical system for receiving an optical image from an object and guiding the optical image to a predetermined position;

image processing means including a sensor for photoelectrically converting the optical image guided to the predetermined position into an electrical signal corresponding to a light amount of the optical image in units of pixels; and

a signal processing device for processing an output from said image processing means in a predetermined form, and outputting the output,

said sensor comprising:

a pixel for outputting a voltage corresponding to noise and the light amount at a first timing, and outputting a voltage corresponding to the noise at a second timing, and

a noise reduction circuit for outputting a difference between a charge amount corresponding to an output voltage from said pixel at the first timing and a charge amount corresponding to an output voltage from said pixel at the second timing.

6. An image system comprising:

an optical system for receiving an optical image from an object and guiding the optical image to a predetermined position;

image processing means including a sensor for photoelectrically converting the optical image guided to the predetermined position into an electrical signal corresponding to a light amount of the optical image in units of pixels; and

a signal processing device for processing an output from said image processing means in a predetermined form, and outputting the output,

said sensor comprising:

a pixel for outputting a first electrical signal corresponding to noise and the light amount at a first timing, and outputting a second electrical signal corresponding to the noise at a second timing, and

a noise reduction circuit for receiving the first and second electrical signals with the same input impedance, and outputting a difference between the first and second electrical signals.

7. An image system comprising:

an optical system for receiving an optical image from an object and guiding the optical image to a predetermined position;

image processing means including a sensor for photoelectrically converting the optical image guided to the predetermined position into an electrical signal corresponding to a light amount of the optical image in units of pixels; and

a signal processing device for processing an output from said image processing means in a predetermined form, and outputting the output,

wherein a dynamic range of outputs from said image processing means is not less than 70 dB.

8. An image system according to any claim 3, in which an output from said sensor is an analog signal, and said image processing means further comprises an analog/digital converter for converting the output from said sensor into a digital signal and a timing signal generation circuit for supplying a timing signal for controlling an operation of said sensor to said sensor.

9. An image system according to claim 8, in which a power level of the timing signal is equal to a power

level supplied to said sensor.

10. An image system according to claim 3, in which an output from said sensor is a voltage signal, and said image processing means further comprises:

a voltage/current converter to which an output from said sensor is supplied;

a current/voltage converter to which an output from said voltage/current converter is supplied;

an amplifier for amplifying an output from said current/voltage converter with a gain corresponding to a desired sensitivity; and

a clamp circuit for clamping an output from said amplifier.

11. An image system according to claim 8, in which an output from said sensor is a voltage signal, and said image processing means further comprises:

a voltage/current converter to which an output from said sensor is supplied;

a current/voltage converter to which an output from said voltage/current converter is supplied;

an amplifier for amplifying an output from said current/voltage converter with a gain corresponding to a desired sensitivity; and

a clamp circuit for clamping an output from said amplifier and supplying the output to said analog/digital converter.

12. An image system according to claim 3, in which

said signal processing device comprises a process circuit for performing a predetermined process for an output from said image processing means, and an encoder circuit for converting an output from said process circuit into a composite video signal.

13. An image system according to claim 3, in which said optical system comprises:

a lens for focusing the optical image;

diaphragm control means for controlling an amount of light incident on said image processing means;

focus control means for controlling a distance between said lens and said image processing means; and

a color filter arranged on said pixel.

14. An image system according to claim 3, in which said image processing means comprises a plurality of image processing means arranged in accordance with wavelengths of the optical image, and

said optical system comprises:

a lens for focusing the optical image;

diaphragm control means for controlling an amount of light incident on said image processing means;

focus control means for controlling a distance between said lens and said image processing means; and

splitting means for splitting the optical image focused by said lens into a plurality of optical images in accordance with wavelengths, and supplying the split optical images to said plurality of image processing

means.

15. An image system according to claim 3, in which said signal processing device comprises storage means for storing an output from said image processing means in a predetermined form.

16. An image system according to claim 3, in which said signal processing device comprises an image monitor for displaying an output from said image processing means in a predetermined form.

17. An image system according to claim 3, in which said signal processing device comprises print means for printing an output from said image processing means in a predetermined form.

18. An image system according to claim 3, further comprising:

an interface circuit to which an output from said signal processing device is supplied;

a signal bus to which an output from said interface circuit is supplied; and

an information processing unit connected to said signal bus.

19. An image system according to claim 8, further comprising:

a frame memory for storing an output from said analog/digital converter; and

a compression unit for compressing a signal stored in said frame memory.

20. An image system according to claim 19, further comprising storage means for storing an output from said compression unit.

21. An image system according to claim 19, further comprising:

an interface circuit to which an output from said image compression unit is supplied; and

a signal bus to which an output from said interface circuit is supplied.

22. An image system according to claim 3, which further comprises a light source for irradiating light on the object, and

in which said signal processing device includes a print unit for printing an image corresponding to the object in accordance with an output from said image processing means, and the optical image is a light emitted from said light source and reflected by the object.

23. An image system according to claim 22, further comprising a moving unit for relatively moving the object and said light source.

24. An image system according to claim 3, which further comprises a light source for irradiating light on the object, and

in which said signal processing device includes a modem for performing signal conversion to transmit an output from said image processing means to a telephone

line, and the optical image is a light emitted from said light source and reflected by the object.

25. An image system according to claim 24, further comprising a moving unit for relatively moving the object and said light source.

26. An image system according to claim 3, which further comprises:

a light source for irradiating light on the object;

moving means for relatively moving the object and said light source; and

position detection means for detecting a positional relationship between the object and said light source, and in which

said signal processing device processes an output from said image processing means by using an output from said position detection means, and

the optical image is light emitted from said light source and reflected by the object.

27. An image system according to claim 3, in which said pixels are one-dimensionally arranged in a predetermined direction in said image processing means,

said optical system includes a lens placed to be movable by said moving means, and a pair of separator lenses placed on the sensor side at a distance from said lens to separate light from said lens into two light components in the predetermined direction and

supply the light components to said sensor, and

said signal processing device detects a distance between focal positions of the two light components from said separator lenses, and outputs a signal for driving said moving means on the basis of the detection result.

28. An image system according to claim 3, which further comprises a light source for irradiating light on the object, and

in which the object is a film which is placed between said light source and said sensor and on which a video is recorded.

29. An image system according to any claim 7, in which an output from said sensor is an analog signal, and said image processing means further comprises an analog/digital converter for converting the output from said sensor into a digital signal and a timing signal generation circuit for supplying a timing signal for controlling an operation of said sensor to said sensor.

30. An image system according to claim 29, in which a power level of the timing signal is equal to a power level supplied to said sensor.

31. An image system according to claim 7, in which an output from said sensor is a voltage signal, and said image processing means further comprises:

a voltage/current converter to which an output from said sensor is supplied;

a current/voltage converter to which an output from said voltage/current converter is supplied;

an amplifier for amplifying an output from said current/voltage converter with a gain corresponding to a desired sensitivity; and

a clamp circuit for clamping an output from said amplifier.

32. An image system according to claim 29, in which an output from said sensor is a voltage signal, and said image processing means further comprises:

a voltage/current converter to which an output from said sensor is supplied;

a current/voltage converter to which an output from said voltage/current converter is supplied;

an amplifier for amplifying an output from said current/voltage converter with a gain corresponding to a desired sensitivity; and

a clamp circuit for clamping an output from said amplifier and supplying the output to said analog/digital converter.

33. An image system according to claim 7, in which said signal processing device comprises a process circuit for performing a predetermined process for an output from said image processing means, and an encoder circuit for converting an output from said process circuit into a composite video signal.

34. An image system according to claim 7, in which

said optical system comprises:

a lens for focusing the optical image;

diaphragm control means for controlling an amount of light incident on said image processing means;

focus control means for controlling a distance between said lens and said image processing means; and

a color filter arranged on said pixel.

35. An image system according to claim 7, in which said image processing means comprises a plurality of image processing means arranged in accordance with wavelengths of the optical image, and

said optical system comprises:

a lens for focusing the optical image;

diaphragm control means for controlling an amount of light incident on said image processing means;

focus control means for controlling a distance between said lens and said image processing means; and

splitting means for splitting the optical image focused by said lens into a plurality of optical images in accordance with wavelengths, and supplying the split optical images to said plurality of image processing means.

36. An image system according to claim 7, in which said signal processing device comprises storage means for storing an output from said image processing means in a predetermined form.

37. An image system according to claim 7, in which

said signal processing device comprises an image monitor for displaying an output from said image processing means in a predetermined form.

38. An image system according to claim 7, in which said signal processing device comprises print means for printing an output from said image processing means in a predetermined form.

39. An image system according to claim 7, further comprising:

an interface circuit to which an output from said signal processing device is supplied;

a signal bus to which an output from said interface circuit is supplied; and

an information processing unit connected to said signal bus.

40. An image system according to claim 29, further comprising:

a frame memory for storing an output from said analog/digital converter; and

a compression unit for compressing a signal stored in said frame memory.

41. An image system according to claim 40, further comprising storage means for storing an output from said compression unit.

42. An image system according to claim 40, further comprising:

an interface circuit to which an output from said

image compression unit is supplied; and

a signal bus to which an output from said interface circuit is supplied.

43. An image system according to claim 7, which further comprises a light source for irradiating light on the object, and

in which said signal processing device includes a print unit for printing an image corresponding to the object in accordance with an output from said image processing means, and the optical image is a light emitted from said light source and reflected by the object.

44. An image system according to claim 43, further comprising a moving unit for relatively moving the object and said light source.

45. An image system according to claim 7, which further comprises a light source for irradiating light on the object, and

in which said signal processing device includes a modem for performing signal conversion to transmit an output from said image processing means to a telephone line, and the optical image is a light emitted from said light source and reflected by the object.

46. An image system according to claim 45, further comprising a moving unit for relatively moving the object and said light source.

47. An image system according to claim 7, which

further comprises:

a light source for irradiating light on the object;

moving means for relatively moving the object and said light source; and

position detection means for detecting a positional relationship between the object and said light source, and in which

said signal processing device processes an output from said image processing means by using an output from said position detection means, and

the optical image is light emitted from said light source and reflected by the object.

48. An image system according to claim 7, in which said pixels are one-dimensionally arranged in a predetermined direction in said image processing means,

said optical system includes a lens placed to be movable by said moving means, and a pair of separator lenses placed on the sensor side at a distance from said lens to separate light from said lens into two light components in the predetermined direction and supply the light components to said sensor, and

said signal processing device detects a distance between focal positions of the two light components from said separator lenses, and outputs a signal for driving said moving means on the basis of the detection result.

49. An image system according to claim 7, which further comprises a light source for irradiating light on the object, and

in which the object is a film which is placed between said light source and said sensor and on which a video is recorded.

50. A solid-state imaging device comprising:

a photoelectric conversion element;

an output circuit including an amplification MOS transistor connected to said photoelectric conversion element and serving to amplify an output from said photoelectric conversion element at a first timing and output noise irrelevant to the output from said photoelectric conversion element at a second timing; and

a noise reduction circuit connected to an output of said output circuit, having the same impedance at the first and second timings when viewed from said output circuit, and serving to obtain a difference between outputs from said output circuit at the first and second timings.

51. A solid-state imaging device according to claim 50, which further comprises a signal line for connecting said output circuit to said noise reduction circuit.

52. A solid-state imaging device according to claim 51, in which said noise reduction circuit

comprises an impedance converter connected to said signal line, and an impedance viewed from said output circuit is an input impedance of said impedance converter.

53. A solid-state imaging device according to claim 52, in which said impedance converter comprises:

an input MOS transistor having a gate connected to said signal line and a source connected to a predetermined potential; and

a load connected between a drain of said second MOS transistor and a power supply potential.

54. A solid-state imaging device according to claim 51, in which said noise reduction circuit comprises a slice transistor having a gate connected to said signal line, and an impedance viewed from said output circuit is a gate capacitor of said slice transistor.

55. A solid-state imaging device according to claim 54, in which said noise reduction circuit further comprises:

a slice capacitor connected between a source of said slice transistor and a slice pulse supply terminal; and

a slice charge transfer capacitor connected between a drain of said slice transistor and a predetermined potential and serving to charge the difference.

56. A solid-state imaging device comprising:

a photoelectric conversion element;

an output circuit including an amplification MOS transistor connected to said photoelectric conversion element and serving to amplify an output from said photoelectric conversion element at a first timing and output noise irrelevant to the output from said photoelectric conversion element at a second timing;

a signal line connected to an output of said output circuit;

a source follower circuit having an input connected to said signal line;

a clamp capacitor having one end connected to an output of said source follower circuit;

a sample/hold capacitor connected between the other end of said clamp capacitor and a first predetermined potential; and

a clamp transistor connected between the other end of said clamp capacitor and a second predetermined potential and serving to selectively clamp said sample/hold capacitor.

57. A solid-state imaging device comprising:

a photoelectric conversion element;

an output circuit including an amplification MOS transistor connected to said photoelectric conversion element and serving to amplify an output from said photoelectric conversion element at a first timing and

output noise irrelevant to the output from said photoelectric conversion element at a second timing;

a signal line connected to an output of said output circuit;

a clamp capacitor having one end connected to said signal line;

a sample/hold capacitor connected between the other end of said clamp capacitor and a first predetermined potential; and

a clamp transistor connected between the other end of said clamp capacitor and a second predetermined potential and serving to clamp said sample/hold capacitor at a predetermined timing.

58. A solid-state imaging device comprising:

a pixel for outputting a voltage corresponding to noise and incident light at a first timing, and outputting a voltage corresponding to the noise at a second timing; and

a noise reduction circuit including a three-terminal element having a first node to which an output from said pixel is supplied, a second node for storing a charge, and a third node to which a predetermined amount of charge controlled in accordance with a potential of said first node is transferred from said second node, and serving to obtain a difference between outputs from said pixel at the first and second timings.

59. A solid-state imaging device according to

claim 58, in which said three-terminal element is an MOS transistor having said first node as a gate, said second node as a source, and said third node as a drain.

60. A solid-state imaging device comprising:

a pixel for outputting a voltage corresponding to noise and incident light at a first timing, and outputting a voltage corresponding to the noise at a second timing; and

a noise reduction circuit for outputting a difference between a charge amount corresponding to an output voltage from said pixel at the first timing and a charge amount corresponding to an output voltage from said pixel at the second timing.

61. A solid-state imaging device comprising:

a pixel for outputting a first electrical signal corresponding to noise and incident light at a first timing, and outputting a second electrical signal corresponding to the noise at a second timing, and

a noise reduction circuit for receiving the first and second electrical signals with the same input impedance, and outputting a difference between the first and second electrical signals.

62. A difference signal output method comprising the following steps of:

applying a first voltage to a gate of an MOS transistor;

resetting a charge stored in a capacitor having

one end connected to a source of said MOS transistor;

applying a first pulse to the other end of said capacitor to discharge a predetermined charge from the source of said MOS transistor through a drain thereof;

applying a second voltage to the gate of said MOS transistor;

applying a second pulse having the same amplitude as that of the first pulse to the other end of said capacitor; and

transferring a charge corresponding to a difference between the first and second voltages from the source of said MOS transistor to the drain.

63. A difference output method comprising the following steps of:

applying a first voltage to one end of a first capacitor and also applying a clamp voltage to the other end of said first capacitor; and

applying a second voltage to said one end of said first capacitor to charge a difference between the first and second voltages in a second capacitor having one end directly connected to the other end of said first capacitor.

64. A difference output method according to claim 63, in which one end of said first capacitor is connected to an output terminal of an impedance converter, and

the first and second voltages are output from said

impedance converter.

65 A difference output method according to claim 62, in which one of the first and second voltages is a sum of an output voltage corresponding to light incident on a pixel of a solid-state imaging element and a fixed pattern noise voltage generated by said pixel, and the other is the fixed pattern noise.

66. A difference output method according to claim 63, in which one of the first and second voltages is a sum of an output voltage corresponding to light incident on a pixel of a solid-state imaging element and a fixed pattern noise voltage generated by said pixel, and the other is the fixed pattern noise.